

CLAIMS

WHAT IS CLAIMED IS:

- 1 1. An integrated circuit package comprising:
2 an integrated circuit die having an active surface; and
3 a cooling fluid in contact with the active surface.
- 1 2. The integrated circuit package of claim 1 further comprising:
2 an interposer coupled to the integrated circuit die.
- 1 3. The integrated circuit package of claim 2, wherein the interposer has a
2 microchannel surface that allows the cooling fluid to flow between the interposer and
3 the active surface of the integrated circuit die.
- 1 4. The integrated circuit package of claim 2 further comprising:
2 a package substrate, wherein a first side of the interposer is coupled to the
3 package substrate via solder bumps, and a second side of the interposer
4 is coupled to the integrated circuit die via solder bumps.
- 1 5. The integrated circuit package of claim 4 further comprising:
2 an underfill material disposed substantially between the interposer and the
3 package substrate.

1 7. The integrated circuit package of claim 1 further comprising:
2 a pump to circulate the cooling fluid.

1 8. A method of forming an integrated circuit package comprising:

2 attaching an interposer to a package substrate;

3 attaching an integrated circuit die to the interposer;

4 covering the package substrate, the integrated circuit die, and the interposer

5 with a heat spreader to form an internal chamber;

6 filling the internal chamber with a cooling fluid.

1 9. The method of claim 8, wherein the filling of the internal chamber is done by
2 pumping cooling fluid through a via in the package substrate.

1 10. The method of claim 9 further comprising:
2 sealing the via after the internal chamber is filled.

1 11. The method of claim 8, wherein the filling of the internal chamber is done by
2 pumping cooling fluid through an inlet, and sealing closed the inlet when the filling is
3 complete.

4 an interposer disposed between the package substrate and the first integrated
5 circuit die, the interposer establishing electrical connectivity between
6 the first integrated circuit die and the package substrate; and
7 a cooling fluid disposed between the first integrated circuit die and the
8 interposer.

1 18. The integrated circuit package of claim 17 further comprising:
2 a heat spreader covering the package substrate, the first integrated circuit
3 die, the cooling fluid, and the interposer.

1 19. The integrated circuit package of claim 18 further comprising:
2 a heat sink coupled to the heat spreader.

1 20. The integrated circuit package of claim 18, wherein the first integrated circuit
2 die has a microchannel surface in contact with the heat spreader, the microchannel
3 surface allowing cooling fluid to flow across the microchannel surface.

1 21. The integrated circuit package of claim 17, wherein the cooling fluid is in
2 contact with the active surface of the first integrated circuit die.

1 22. The integrated circuit package of claim 17, wherein the interposer provides
2 electrical functionality in addition to electrical connectivity.

2 capacitance.

1 24. The integrated circuit package of claim 22, wherein the interposer comprises a
2 second integrated circuit die.

2 second integrated circuit die.

1 25. The integrated circuit package of claim 24, wherein the second integrated
2 circuit provides an optical to electrical interface for the first integrated circuit die.

2 circuit provides an optical to electrical interface for the first integrated circuit die.

1 26. The integrated circuit package of claim 17, wherein the interposer has a
2 microchannel surface in contact with the active surface of the first integrated circuit die.

2 microchannel surface in contact with the active surface of the first integrated circuit die.

1 27. An integrated circuit package comprising:

2 a integrated circuit die housed within a chamber;

3 a cooling fluid filling the chamber and in contact with the integrated circuit

4 die.

1 28. The integrated circuit package of claim 27 further comprising:

2 a plurality of microchannels in a surface of the integrated circuit die.

1 29. The integrated circuit package of claim 28 further comprising:

2 a pump located within the integrated circuit package to pump the cooling

3 fluid through at least a portion of the plurality of microchannels.